State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Engineering Division
Honolulu, Hawaii 96813

April 8, 2010

Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

APPLICATION FOR A DLNR DAM SAFETY CONSTRUCTION/ALTERATION PERMIT
PERMIT NO. 38 – KAPALAALAEA RESERVOIR (HI00094)
OUTLET PIPE REPAIR, PAIA, MAUI

The Engineering Division hereby submits an application for your authorization and approval for issuance of a Dam Safety Construction/Alteration Permit for the reservoir repair at the Kapalaalaea Reservoir, to East Maui Irrigation Company, Pursuant to Chapter 179D Hawaii Revised Statutes and Chapter 190 Hawaii Administrative Rules.

APPLICANT:
Mr. Mark Vaught
East Maui Irrigation Company
P.O. Box 791628
Paia, HI 96779

LANDOWNER:
Same as applicant

SUMMARY OF REQUEST:
Application for a Dam Safety Construction/Alteration Permit for outlet pipe repair at the Kapalaalaea Reservoir/Dam (HI00094), Paia, Maui, TMK: 2-2-800:7001 See Exhibit 1.

LOCATION: Paia, Maui. See Exhibit 2.

BACKGROUND:
In the fall of 2007, a sinkhole was discovered on the upstream embankment of the Kapalaalaea Reservoir. The reservoir was taken out of service at that time and an investigation was conducted to find the cause of this sinkhole. The consulting engineer, LFR Inc. concluded that there are holes in the outlet pipe and the head pressure pushed the water through the holes eroding the embankment material that caused the formation of the sinkhole. A preliminary application for the repair of the Kapalaalaea Dam was filed on December 5, 2008 by the dam owner, East Maui Irrigation Company.

DESCRIPTION:
The Kapalaalaea Reservoir consists of an earthen embankment which is approximately 350 ft. long, 48 ft high. The reservoir covers an area of approximately 6.5 acres at full pond. The normal storage capacity of

this reservoir is approximately 153 acre-feet or 50 million gallons. The existing outlet works consists of a 16" steel pipe slip lined inside a 20" pipe. Erosion of the 20" pipe caused erosion of the embankment. To mitigate the deficiency of the outlet pipe, the owner's representative, LFR, Inc. is proposing to seal the interstitial void between the outer 20" conduit and the 16" iron pipe with grout. The concrete headwalls on the downstream and upstream ends will be rebuilt.

REMARKS:
East Maui Irrigation Company and its consultants, LFR Inc., have completed a basis of design, plans and requests for the approval of a dam safety construction/alteration permit. The Department along with their consultant, GEI Consultant has reviewed the plans and concluded that it is sufficient for its intended purposes. Staff recommends approval of this permit application. See Exhibit 4.

RECOMMENDATION:

That the Board:

1. Authorize the approval and issuance of the Dam Safety Construction/Alteration Permit for this project; and
2. Direct the Chairperson to issue a dam safety permit for the repair of the Kapalaalaea Dam (DLNR Dam Safety Construction/Alteration Permit No. 38) subject to such other terms and conditions as may be prescribed by the Chairperson to best serve the interests of the State.

Respectfully submitted,

CARTY S. CHANG
Acting Chief Engineer

APPROVED FOR SUBMITTAL:

LAURA H. THIELEN, Chairperson

Exhibit(s):
1 Owner Permit Application
2 Scope of Work and Location Plan
3 Construction Drawing pages and site plan and profile
4 LFR Responses to Comments
5 DLNR Consultant Final Review
6 Proposed Permit Approval Conditions
7 Dam Safety Permit General Conditions

State of Hawaii
DEPARTMENT OF LAND AND NATURAL RESOURCES
Engineering Division
Honolulu, Hawaii 96813

Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

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APPLICANT:
Mr. Mark Vaught
East Maui Irrigation Company
P.O. Box 791628
Paia, HI 96779

LANDOWNER:
Same as applicant

SUMMARY OF REQUEST:
Application for a Dam Safety Construction/Alteration Permit for outlet pipe repair at the Kapalaalaea Reservoir/Dam (HI00094), Paia, Maui, TMK: 2-2-800:7001 See Exhibit 1.

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1. Authorize the approval and issuance of the Dam Safety Construction/Alteration Permit for this project; and
2. Direct the Chairperson to issue a dam safety permit for the repair of the Kapalaalaea Dam (DLNR Dam Safety Construction/Alteration Permit No. 38) subject to such other terms and conditions as may be prescribed by the Chairperson to best serve the interests of the State.

Respectfully submitted,

CARTY S. CHANG
Acting Chief Engineer

APPROVED FOR SUBMITTAL:

LAURA H. THIELEN, Chairperson

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State of Hawaii
BOARD OF LAND AND NATURAL RESOURCES
Department of Land and Natural Resources
Engineering Division

APPLICATION FOR APPROVAL OF PLANS AND SPECIFICATIONS FOR CONSTRUCTION, ENLARGEMENT, REPAIR, ALTERATION, OR REMOVAL OF A DAM

Date of Application: 12/5/08

Applicant:
Contact Name: Mark Vaught Firm / Company: East Maui Irrigation

Mailing Address P.O. Box 791628, Paia, HI 96779

Telephone: 579-9516 Fax: 579-9517 Email: mvaught@hcsugar.com

The Applicant hereby applies to the Board of Land and Natural Resources for the approval of the attached plans and specification for the outlet pipe repair (construction, etc.) in accordance with Chapter 179D HRS (as amended by Act 262, SLH 2006), and subject to the provisions, conditions, and limitations of the current Hawaii Administrative Rules and various DLNR dam safety guidelines.

Accompanying this application are:	(please check)
1. Filing fee ($25.00) (Waived for government agencies)	25.00
2. Three (3) copies of the Detailed Cost Estimate	
3. Three (3) copies of the Final Design Report	
4. Three (3) copies of the Plans	
5. Three (3) copies of the Specifications	
6. Proposed Construction Schedule	
7. Supporting documents:	
_____	
_____	
_____	

NAME OF STRUCTURE: Kapalaalaea

DAM OR RESERVOIR LOCATION: Hana Hwy, East of Opana gulch

Island: Maui Tax Map Key: 2 2 800 7001

Attach USGS topographic map (scale 1" = 2000') and property tax map (showing location access to site, proposed work)

State Land Use District: X Agriculture ___ Urban ___ Rural ___ Conservation

BRIEF DESCRIPTION OF WORK TO BE PERFORMED
Grout outlet interstitial space to prevent leakage. Prevent soil piping near outlet conduit.

EXHIBIT 1

TECHNICAL INFORMATION: DLNR-Dam Safety-Sheet 2

1. Drainage Area 0.89 sq. miles or _____ acres

2. Classification of Dam Intermediate, Low-hazard

3. Type of Structure Earthen Embankment Dam

4. Elevation-Area-Capacity Data:

	Elevation	Surface Area (acres)	Total Storage Volume (acre-feet)
Natural Streambed	555 ft msl		
Primary Spillway	594.5 ft msl		153 ac-ft
Secondary Spillway			
Top of Dam	600 ft msl	8.7 acres	197 ac-ft
Design Water Level	varies		
Invert of Drain			

5. Spillway Details (Type, Dimensions, Material)
   Primary: earth-lined trapezoidal ditch 10 feet wide, 3 feet deep & 100 feet long
   Secondary: _____

6. Purpose of Structure Irrigation
   (water supply, irrigation, recreation, real estate development, etc.)

7. Attach rainfall and stream flow records, and flood-flow records and estimates (as accurately as may be readily obtained) See Phase I Dam Investigation Report, LFR, September 5, 2007

ADDITIONAL INFORMATION

1. Primary Owner Contact (if different from applicant) Same as applicant
   Owner Company or Entity: _____
   Mailing Address _____
   Telephone: _____ Fax: _____ Email: _____

2. Registered Hawaii Professional Engineer who prepared the plan Jeffrey Morrell
   Mailing Address 220 S. King Street, Suite 1290, Honolulu, HI 96813
   Registration No. 8426-C
   Telephone: 522-0321 Fax: 522-0366 Email: jeff.morrell@lfr.com

3. Registered Professional Engineer to be responsible for inspection during construction
   Jeffrey Morrell

4. Contractor (If known) East Maui Irrigation; Maui Mayco, Valley Well Drilling
   Mailing Address PO Box 791628, Paia, HI 96779
   Telephone: 579-9516 Fax: _____ Email: _____

5. List all other permits applications submitted to other governmental agencies:
   None

6. Anticipated effect of proposed structure on natural environment: None

7. List all other parties that have ownership or other interest on the parcels where the dam and reservoir are located and identify their interest in the property. The Owners herein listed below concur with the work proposed within this application by the applicant and by his/her signing hereto, the owner of the land extends to the Board of Land and Natural Resources, and its designated representatives, a right-of-entry onto the project site to conduct any investigations or inspections required in compliance with the provisions of Chapter 13-190, Hawaii Administrative Rules. (Submit additional copies of this sheet should there be more owners)

(Signature of Owner)	(Address / Interest in Dam or Reservoir)
Mark Vaught East Maui Irrigation Co., Ltd.	P.O. Box 791628 Paia, HI 96779 / owner/operator

I, Mark Vaught, the applicant, hereby certify that the information herein is true and factual to the best of my knowledge. Signing below indicates that the applicant understands that, if the permit requested is granted by the Board of Land and Natural Resources, the proposed work is to be initiated and completed within two (2) years of the approval date, unless specifically permitted in the approved permit terms and conditions.

Mark Vaught, Operations Manager Date: 1/27/09
(Signature of Applicant & Title)

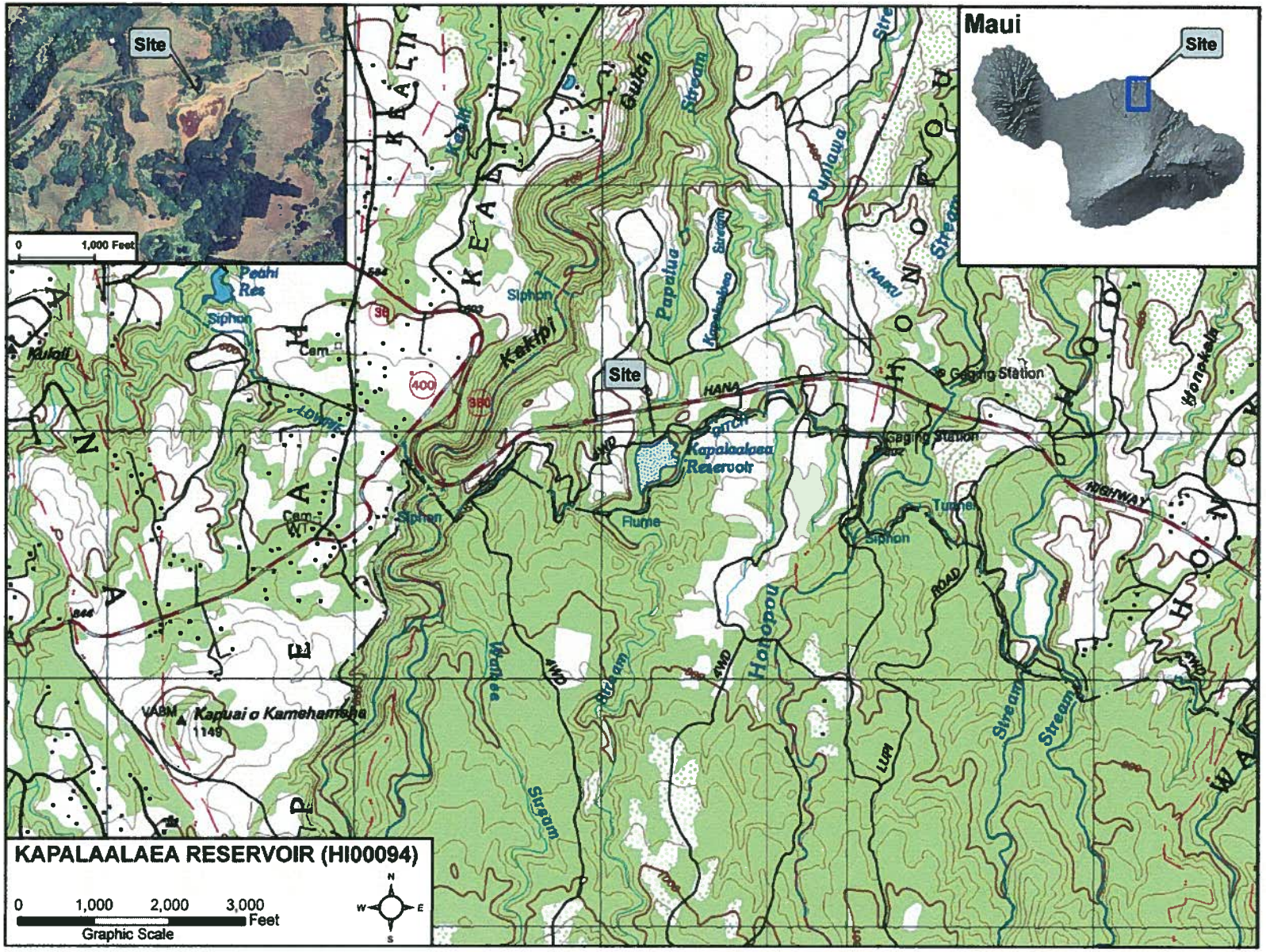


EXHIBIT 2

2/22/2010

Kapalaalaea Outlet Repair
Scope of Work
East Maui Irrigation

Revision 1 – 11/12/2008

Revision 2 – 12/9/2008

Revision 3 – 2/20/2009

Revision 4 - 7/30/2009

Revision 5 – 9/15/2009

I. Drawings – Refer to Civil Drawings C1-Plan View, C2-Excavation and Fill Section, and C3-Details for additional clarification and specifications. Drawings take precedent in the case of any discrepancies or contradictory information.

II. Access to pipe

A. Infrastructure removal

i. East Maui Irrigation (EMI) Company shall remove the partially buried wooden trash rack protecting the outlet pipe's upstream opening

ii. EMI shall remove the concrete headwall on the upstream and downstream ends of the outlet pipe.

B. Interstitial sediment removal

i. EMI shall provide 2,000 gallons water of delivered to the site via a water truck to flush the interstitial space.

ii. The water will be introduced to the interstitial space using a 20 ft section of 2" PVC pipe attached to a 4" hose connected to the water truck.

iii. LFR personnel will observe and photograph the water and sediment coming out of the outlet pipe. LFR will also set up a catch pan or bucket to quantitatively estimate the sediment leaving the outlet pipe.

iv. The water pressure at the exit of the outlet pipe shall not exceed 20 ft of head (8.7 psi).

III. Inspection

A. Trenching

i. EMI shall excavate enough of the upstream embankment of the dam to expose about 20 ft of the upstream end of the outlet pipe. LFR anticipates exposing only the top half of the pipe. The bottom half of the pipe will remain buried unless LFR deems further inspection is necessary.

ii. Shoring or stepped excavations shall be installed for all trenching work that is deeper than 5 feet below ground surface (bgs). Shoring or stepping shall be installed in accordance with Hawaii OSHA requirements.

iii. Excavation shall be keyed in to undisturbed embankment soil as shown in drawing C2.

B. Visual inspection

i. LFR will conduct an inspection of the outer pipe observing the conduit for corrosion, pinholes, and any damage. LFR will photograph the pipe to document the condition of the original outer riveted steel pipe.

IV. Installation of tremie pipe

A. Roller Guide Assembly or Pull wire

i. Tremie pipe may be installed using either a roller guide assembly or a pull wire at the discretion of the Contractor (East Maui Irrigation).

ii. Contractor may use air pressure to move a plug attached to a pull line down the entire 230 ft length of the interstitial space. The maximum opening on the top of the inner pipe is about 3 inches.

iii. Contractor may use a pull wire to pull a tremie pipe through the length of the outlet pipe.

B. Tremie pipe

i. The tremie pipe will be 1 ½" to 2" in diameter made of HDPE thin wall construction. The pipe will be 240 continuous feet with no joints.

ii. The purpose of a tremie pipe is to serve as the conduit to deliver grout to fill the interstitial space without leaving voids.

V. Pre-grouting

A. Packer

i. From the lower end of the outlet pipe, Valley Well Drilling (VWD) shall insert an inflatable packer into the inner pipe using a small diameter 33 ft length of PVC pipe.

ii. VWD shall inflate the packer so that it blocks the hole in the inner pipe located at 197' from the inlet of the pipe.

iii. EMI shall provide an air compressor at the site capable of delivering 1 ACFM at 35 psi.

B. Lower terminus

i. EMI shall install the following fittings: three (3) clean-out/drain pipes will be installed in the interstitial space between the inner and outer outlet pipes at the downstream terminus. The top clean-out shall be 1.5" OD, and the two side clean-out pipes shall be 1" OD. The clean-out pipes shall be either PVC or HDPE construction. Each clean-out shall be fitted with a 1" or 1.5" PVC gate valve.

ii. The clean-out/drain lines shall be grouted in place with a minimum 12" long/thick grout plug as shown on drawing C3.

VI. Cement Slurry

A. Specifications

i. A 1:1 cement slurry will be used: 1 pound of Portland cement to 1 pound of water

ii. A set up retardant may provide up to 3 hours before slurry begins to harden.

B. Grout pump specification

i. Maui Mayco shall provide a hydraulic cement pump to move the slurry through the hose and tremie pipe. This pump will allow EMI/LFR to control the pressure and volume during pumping.

ii. The pump will be operated at the minimum functioning pressure of about 10 bar (or 145 psi). The maximum pressure is about 200 bar (2901 psi).

VII. Interstitial grouting

A. Grouting procedure

i. Because the interstitial space is both deep and narrow a tremie pipe must be used to grout the interstitial space. A tremie pipe keeps the sealing materials from becoming bridged inside the space and prevents dissolution of the liquid slurry. The end of the tremie pipe must remain submerged and must be removed as the interstitial space is filled.

ii. The slurry will be pumped into the interstitial space until it is expressed from the vent and cleaning valves at the downstream end of the outlet system.

iii. 5.7 cubic ft (0.21 cubic yds) of slurry needs to be inserted into every 10 linear ft of interstitial space. After 5.7 cubic ft of slurry have been delivered the pipe should be withdrawn 10 ft and the process shall be repeated.

iv. The entire interstitial space will be grouted by withdrawing the tremie pipe in 10 ft increments.

v. The engineer shall monitor and record the pressure at the grout pump to ensure that the pressure at the pump remains near the low end of the operating pressure range of 145 to 200 psi. Any sudden increase in operating pressure means that the tremie pipe is plugged or a bridge has formed in the interstitial space. In either case the grout pump will be shut down and the problem will be resolved before grouting continues.

B. Total slurry requirement

i. A minimum total of 4.87 cubic yards (132 cubic feet) of slurry will be needed to fill the interstitial space.

ii. The amount of slurry needed will increase if there are voids that need to be filled outside the outer pipe.

iii. The pressure will be monitored to provide an indication that voids are present.

iv. Engineer shall monitor and record the amount of grout installed at each 10 linear foot station.

VIII. Rebuilding outlet works

A. Upstream

i. The upstream pipe will remain in the same location.

ii. Any damaged concrete in the inlet chamber will be repaired.

iii. A new concrete headwall will be formed. All voids between the inner and outer pipe shall be grouted before the headwall is constructed.

B. Downstream

i. The temporary drainage/vent valves will be removed and any voids in the drain/clean-out pipes or space between the inner and outer outlet pipe shall be grouted.

ii. The abandoned and grout-filled clean-out/drain pipes may be encased within the new concrete head-wall.

iii. A new headwall matching the demolished headwall at the downstream terminus will be installed.

iv. The gate valve on the outlet pipe will be re-installed to provide downstream control and an emergency shut off.

IX. Rebuilding the Embankment

A. Replacing soil (Refer to drawing sheets C1, C2, and C3)

i. Initial fill over crown of exposed outer pipe will be a 4" minimum lift.

ii. Contractor shall exercise due caution not to disturb the bedding of the pipe.

iii. Less than one cubic yard of controlled density fill shall be used to fill the void under the pipe and above the T-base of the headwall foundation at the upstream and downstream terminus of the outlet pipe. Controlled density fill shall be installed under the direction of the LFR geotechnical engineer.

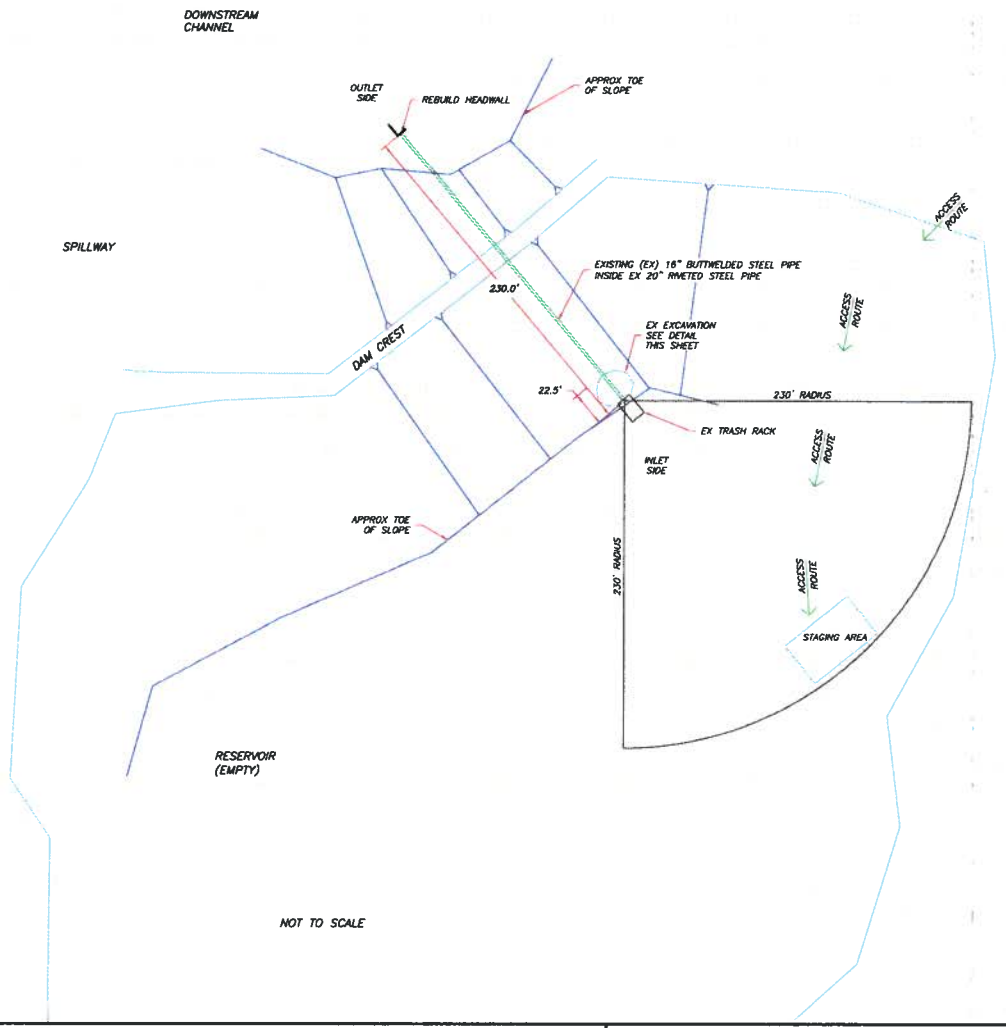
iv. Excavation shall be filled in 4-inch maximum lifts with native soils and compacted to 95% modified proctor at 2% wet of optimum moisture content, or as deemed acceptable by geotechnical engineer.

B. Finishing Embankment

i. Existing cuts shall be cut back to 1V:1H slope and benched as shown on Sheet C-2

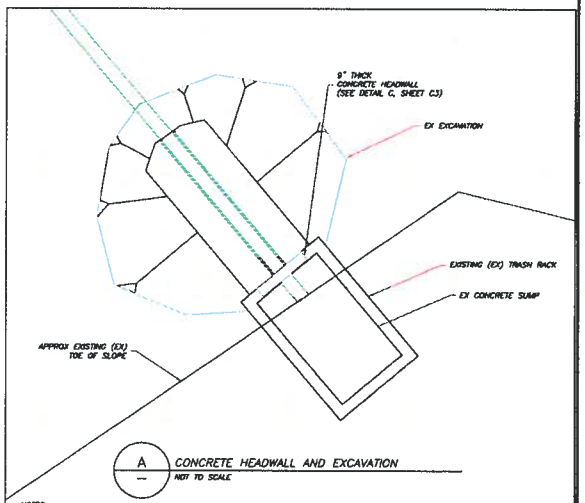
ii. The final slope is the match the existing 2 horizontal : 1 vertical slope.

iii. Four inch plus basalt rock will replace riprap on the slope to match the existing extent of rip-rap.



ACCESS NOTES:

1. STAGING AREA SHALL CONSIST OF 6 INCHES OF CLASS 2 AB. ACCESS ROUTE SHALL BE AMENDED WITH CLASS 2 AB AS NEEDED.



A — CONCRETE HEADWALL AND EXCAVATION
NOT TO SCALE

NOTES:

1. SEE SHEET C3 SECTION FOR FILL DETAILS.

THIS WORK WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

SIGNATURE

DATE

REVISION HISTORY

NO.	DESCRIPTION	DATE	APPROVED
1.	Corrected thickness of concrete headwall.	7/24/09	

LICENSED PROFESSIONAL
ROBERT B. HARPER
APRIL 30,2010
EXPIRATION DATE

LFR
220 South King St.
Suite 1290
Honolulu, HI 96813
Phone: (808) 522-0321
Fax: (808) 522-0366

PLAN VIEW

EAST MAUI IRRIGATION
KAPALAALAEA RESERVOIR
MAUI, HAWAII

DRAWN BY:	HWK
REVIEWED BY:	BRH
APPROVED BY:	JCM
REVISION NO:	1
ORIGINAL ISSUE DATE:	02/18/09
PROJECT NO:	005-12094-02

SHEET NO: C1

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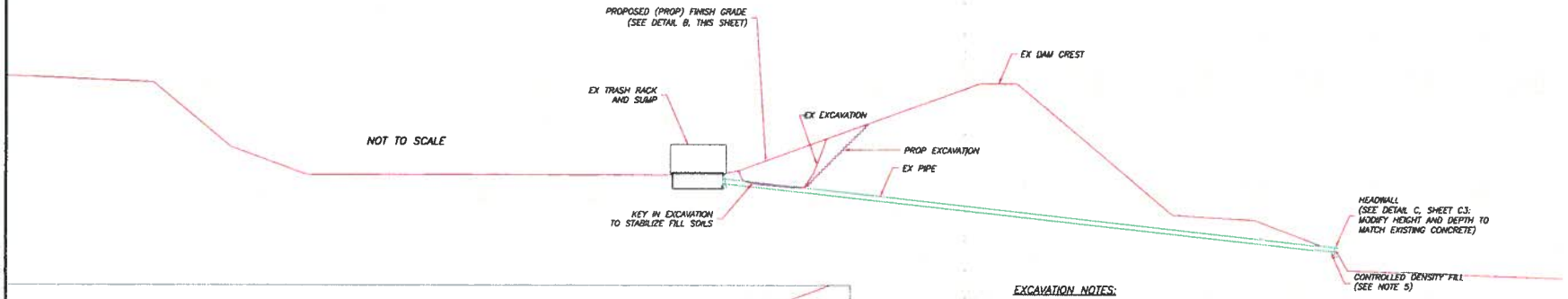
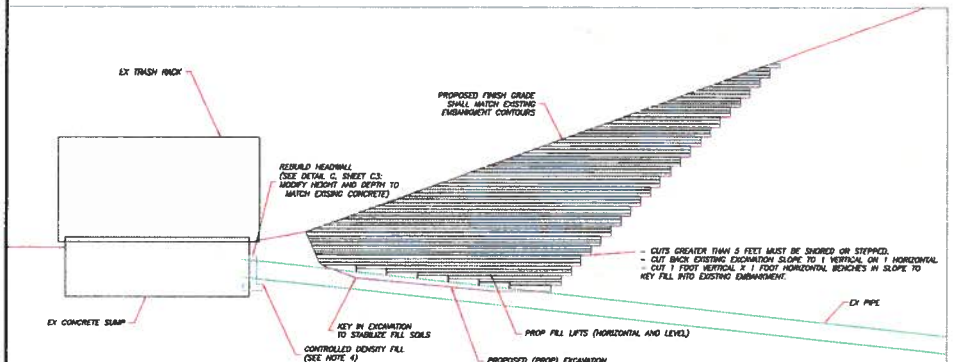
EXHIBIT 3





B — FILL PLACEMENT SECTION

FILL NOTES:

1. EXCAVATION SHALL BE FILLED IN 4-INCH LIFTS MAXIMUM (EXCEPT FOR INITIAL LIFT OVER PIPE, SEE NOTE 2) WITH NATIVE SOILS AND COMPACTED TO THE SAME DENSITY AS THE EXISTING EMBANKMENT, OR AS DEEMED ACCEPTABLE BY GEOTECHNICAL ENGINEER.
2. INITIAL FILL OVER CROWN OF PIPE SHALL BE 4" MINIMUM
3. CONTRACTOR SHALL EXERCISE DUE CAUTION NOT TO DISTURB BEDDING OF PIPE.
4. BACKFILL WITH CONTROLLED DENSITY FILL OR NON-SHRINK GROUT BETWEEN THE TOP OF THE HEADWALL FOUNDATION AND THE SPRINGLINE OF THE OUTLET PIPE.
5. NO MATERIALS LARGER THAN 6-INCH MAXIMUM DIMENSION PERMITTED FOR RECONSTRUCTION OF THE EMBANKMENT DAM.

EXCAVATION NOTES:

1. EXCAVATE SOILS SURROUNDING PIPE TO PIPE SPRINGLINE.
2. CONSTRUCT CONCRETE HEADWALL WALL AS SHOWN ON SHEET 3, DETAIL C.
3. EXCAVATION SHALL BE KEYED IN AT FRONT AS SHOWN.
4. CONTRACTOR SHALL EXERCISE DUE CAUTION NOT TO DISTURB BEDDING OF PIPE.
5. BACKFILL WITH CONTROLLED DENSITY FILL (CDF) OR NON-SHRINK GROUT BETWEEN THE TOP OF THE HEADWALL FOUNDATION AND THE SPRINGLINE OF THE OUTLET PIPE.
6. SPECIFICATION FOR CDF:
   - 6.1. CEMENTITOUS MATERIALS SHALL BE PORTLAND CEMENT IN COMBINATION WITH FLY ASH.
   - 6.2. ADMIXTURE SHALL BE AN AIR-ENTRAINING AGENT.
   - 6.3. AGGREGATE CONTENT: CDF MIXTURE SHALL CONTAIN NO AGGREGATE LARGER THAN 3/8 INCH. AMOUNT PASSING A NO. 200 SIEVE SHALL NOT EXCEED 15 PERCENT NOR BE LESS THAN 10 PERCENT. NO PLASTIC FINES SHALL BE PRESENT.
   - 6.4. AIR CONTENT: TOTAL CALCULATED AIR CONTENT OF THE SAMPLE, PREPARED IN ACCORDANCE WITH ASTM C231, SHALL NOT EXCEED 30 PERCENT.
   - 6.5. STRENGTH: CDF SHALL HAVE AN UNCONFINED COMPRESSIVE STRENGTH AT 28 DAYS OF FROM 50 PSI TO A MINIMUM OF 150 PSI.

THIS WORK WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

SIGNATURE

DATE

REVISION HISTORY

NO.	DESCRIPTION	DATE	APPROVED
1.	Added specification for CDF to replace references to flowable fill. Decreased the depth of the fill lifts and the slope of the cut.	7/24/09	

LICENSED PROFESSIONAL

APRIL 30, 2010
EXPIRATION DATE

LFR
220 South King St.
Suite 1290
Honolulu, HI 96813
Phone: (808) 522-0321
Fax: (808) 522-0366

EXCAVATION AND FILL PROFILE

EAST MAUI IRRIGATION
KAPALAALAEA RESERVOIR
MAUI, HAWAII

DRAWN BY:	HWK
REVIEWED BY:	BRH
APPROVED BY:	JCM
REVISION NO:	1
ORIGINAL ISSUE DATE:	03/18/09
PROJECT NO:	005-12094-02

SHEET NO:
C2

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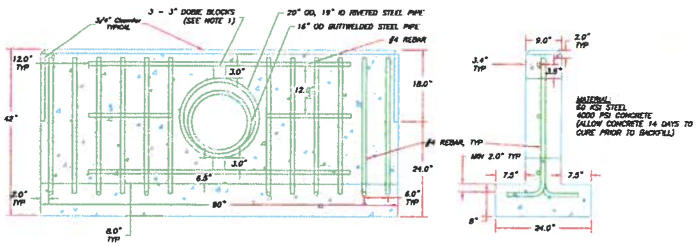
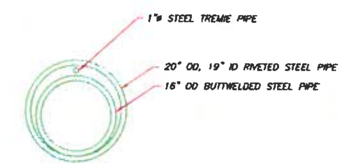


C — CONCRETE HEADWALL TYPICAL 2 PLACES

NOTES:

1. CONTRACTOR SHALL USE 3" DOBIE BLOCKS AFFIXED WITH ADHESIVE TO TOP OF PIPE TO PROVIDE PROPER SPACING BETWEEN REBAR AND PIPE AS WELL AS TO PREVENT CORROSION BETWEEN DISSIMILAR METALS. USE EXISTING TIE WIRE ON DOBIE BLOCKS TO HOLD REBAR TO DOBIE BLOCK.
2. ALLOW CONCRETE HEADWALL TO CURE FOR 14 DAYS PRIOR TO BACKFILL
3. VERTICAL #4 REBAR WILL HAVE EVERY OTHER HOOK POINTING TO THE OPPOSITE DIRECTION IN THE FOOTING.

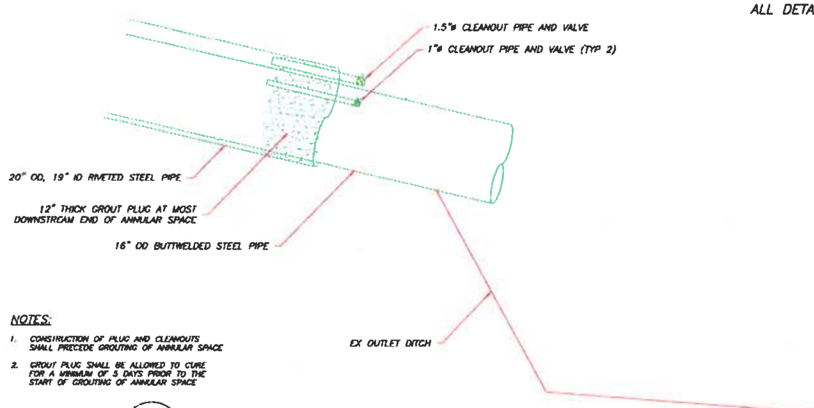


D — GROUT OF ANNULAR SPACE

NOTES:

1. TREMIE PIPE SHALL BE PUSHED THROUGH THE ANNULAR SPACE USING A ROLLER-GUIDE ASSEMBLY.
2. PRIOR TO START OF GROUT PUMPING OPERATIONS, TEST ROLLER GUIDE ASSEMBLY FOR FULL LENGTH OF PIPE.
3. A MINIMUM OF 150 FEET OF FLEXIBLE HOSE SHALL CONNECT THE CONCRETE PUMP TO THE TOP END OF THE TREMIE PIPE ONCE THE TREMIE PIPE HAS BEEN FULLY INSERTED INTO THE ANNULAR SPACE.

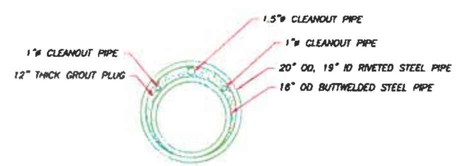
ALL DETAIL DRAWINGS TO SCALE



NOTES:

1. CONSTRUCTION OF PLUG AND CLEANOUTS SHALL PRECEDE GROUTING OF ANNULAR SPACE
2. GROUT PLUG SHALL BE ALLOWED TO CURE FOR A MINIMUM OF 5 DAYS PRIOR TO THE START OF GROUTING OF ANNULAR SPACE

E — PROFILE OF PLUG & ANNULAR SPACE VENT/CLEANOUT



F — SECTION OF PLUG & ANNULAR SPACE VENT/CLEANOUT

THIS WORK WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION.

SIGNATURE — DATE

REVISION HISTORY

NO.	DESCRIPTION	DATE	APPROVED
1.	Additional horizontal stud; revised vertical rebar placement	7/24/09	

LICENSED PROFESSIONAL
APRIL 30, 2010
EXPIRATION DATE

LFR
220 South King St.
Suite 1290
Honolulu, HI 96813
Phone: (808) 522-0321
Fax: (808) 522-0366

DETAILS

EAST MAUI IRRIGATION
KAPALAALAEA RESERVOIR
MAUI, HAWAII

DRAWN BY: HWK
REVIEWED BY: BRH
APPROVED BY: JCM
REVISION NO: 1
ORIGINAL ISSUE DATE: 02/18/09
PROJECT NO: 005-12094-02

SHEET NO: C3

I:\Active Projects\005-12094-02 Kapalaalaea Outlet Repair\Draft Drawings and Specifications\C1-C3 Harper04.dwg Sep 17,2009-8:22am

LFR an ARCADIS company

September 22, 2009 005-12094-02

Mr. Eric Hirano
Engineering Division
Department of Land and Natural Resources
Post Office Box 373
Honolulu, Hawaii 96809

Subject: Response to comments on the Kapalaalaea Dam Repair Application – Dam Permit No. 38
DLNR DAM No. MA0094, Island of Maui, Hawaii – Memorandum of Design Review dated March 17, 2009

Dear Mr. Hirano,

On behalf of East Maui Irrigation Company, LFR Inc. has prepared the attached responses to the Department of Land and Natural Resources' (DLNR) consultant comments on the proposed repair of the outlet pipe at Kapalaalaea Dam.

General Comments

Comment: *Some of the comments provided by GEI in the December 18, 2008 review memo are repeated in this memo.*

Response: Acknowledged.

Comment: *An upstream control valve is included in the scope of work. Design details of the valve and its foundation should be submitted for review.*

Response: Construction of the upstream control valve has been postponed as part of an agreement with DLNR. Design details of the valve and its foundations will not be submitted at this time.

Comment: *No materials larger than 6-inch maximum dimension should be permitted in an 8-inch layer for reconstruction of the embankment dam.*

Response: We agree and have reproduced this comment on the drawing.

Comment: *Backfill materials which cannot be compacted by roller equipment because of inadequate clearances should be spread in 4-inch-thick layers and each layer should be compacted with power tempers [sic] to the required density. A 12-inch minimum lift over the crown of the pipe may not be compacted to the specified relative compaction.*

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EXHIBIT 4

Response: LFR agrees. We will backfill materials in 4-inch lifts and compact using power tampers in areas which are inaccessible to roller equipment.

Comments on Scope of Work

Section III. Inspection, Item A-ii

Comment: *For dam construction, stepping or benching is not recommended.*

Response: While benching the excavation is not optimal, safety concerns require that the slope be benched. The benches will be scarified to provide a good bonding surface for the overlying fill. In addition, the fill will be arranged so that the horizontal benches are at mid depth of the adjacent fill lift – i.e., the top of the first lift below the bench will be 4 inches below the bench and the subsequent lifts will extend 4 inches above the bench.

Section VI. Cement Slurry, Item B-ii

Comment: *A minimum grout pressure of 145 psi may cause hydraulic fracture or uplift of the embankment when the grout exits the damaged outer pipe with pressure greater than the soil pressure around it.*

Response: The minimum grout pressure of 145 psi will occur at the pump, not in at the interstitial space between the existing pipes. The interstitial space will remain open to the atmosphere to prevent overpressure. Additionally, due to friction losses the exit pressure of the slurry will be much lower than the initial pressure used to pump the slurry through the tremie pipe. We do not anticipate fracturing to be an issue as the embankment will provide support for the outer pipe that will only experience pressures of less than 1 – 2 psi as the slurry exits the tremie pipe and flows through any holes in the outer pipe. LFR will monitor the volume pumped and the pressure for changes to avoid over-pressure and ensure continuous flow. If a sudden buildup in pressure to observed, we will cease pumping to determine the cause of the pressure buildup before proceeding.

Section IX. Rebuilding the Embankment, Items A-I and A-iii

Comment: *A 12-inch minimum lift over the crown on the pipe may be too thick to obtain the specified relative compaction.*

Response: LFR agrees. We will use a 4-inch minimum lift over the crown of the pipe as recommended.

Comment: *To cover and protect the pipe from damages by the static and dynamic loads of heavy equipment, the contractor should consider backfilling the outlet pipe with 4-inch*

loose lifts and compacting with small compacting equipment around the pipe to meet the density requirements, as previously recommended.

Response: LFR agrees. We will use 4 inch lifts and compact with small compacting equipment around the pipe.

Comment: *The specifications indicate the flowable fill will be used to fill the void under the pipe and above the T-base of the headwall foundation. The specification or definition of the flowable fill should be provided.*

Response: Controlled density fill (CDF) shall be composed of cementitious materials, aggregate, water, and an air-entraining admixture, as follows:

1. Cementitious materials shall be Portland cement in combination with fly ash.

2. Admixture shall be an air-entraining agent.

3. Aggregate Content: CDF mixture shall contain no aggregate larger than 3/8 inch. Amount passing a No. 200 sieve shall not exceed 15 percent nor be less than 10 percent. No plastic fines shall be present.

4. Air Content: Total calculated air content of the sample, prepared in accordance with ASTM C231, shall not exceed 30 percent.

5. Strength: CDF shall have an unconfined compressive strength at 28 days of from 50 psi to a maximum of 150 psi.

Comment: *Specify what materials and method will be used to fill the space between the springline of the pipe and the top of the flowable fill.*

Response: The CDF will be installed between the top of the base of the headwall foundation up to the springline of the pipe. We expect to use less than a cubic yard of material for this purpose and can substitute non-shrink grout if that would be preferable.

Sheet No. C1, Details A

Comment: *Detail A shows a 12-inch thick headwall; Detail C on Sheet C3 shows a 9-inch thick wall. Need clarification and revision.*

Response: Detail C on Sheet C3 showing a 9-inch thick wall is correct. Detail A has been corrected to show a 9-inch thick wall.

Sheet No. C 2, Section B

Comment: *The cut slope is probably too steep for the fill to be compacted against it effectively to meet the density requirements; use vibratory sheetfoot attachment to the backhoe or small compactor such as Wacker rammer to compact the edge of the lifts against the cut slope. For dam construction, stepping or benching is not recommended at the steep slope or at the edge of each horizontal lift.*

Response: We will use a vibratory sheetfoot attachment to the backhoe if available, or a small compactor to compact the edge of the lifts against the cut slope. While benching the excavation is not optimal, safety concerns require that the slope be benched. The benches will be scarified to provide a good bonding surface for the overlying fill. In addition, the fill will be arranged so that the horizontal benches are at mid depth of the adjacent fill lift – i.e., the top of the first lift below the bench will be 4 inches below the bench and the next lift will extend 4 inches above the bench.

Comment: *Note 1 – Provide the types of compacting equipment to be used and the types and the frequency of soil density test if performance specifications are to be used. We recommend compacting the backfill to the same density as that of the exiting embankment.*

Response: A small compactor, such as reversible plate compactor or rammax roller, will be used to compact the soil to the same density as the existing embankment, or as deemed acceptable by geotechnical engineer. A nuclear gage density test will be used after compaction to ensure that the proper compaction has been achieved.

Comment: *Note 2 – A 12-inch minimum initial fill over the crown of the pipe may be too thick to obtain the specified relative compaction.*

Response: LFR agrees. The note has been changed to indicate a 4-inch lift over the crown of the pipe.

Comment: *Note 4 – Provide the specification of the flowable fill.*

Response: See above response.

Comment: *Provide the type of material and compaction method to be used between the springline of the pipe and the top of the flowable fill.*

Response: See above response.

Sheet No. C3, Section C

Comment: *The space between vertical #4's is less than two inches as detailed. For 9-inch wall, consider using one layer of reinforcement with every other hook pointing to the opposite directions in the footing.*

Response: LFR agrees. The detail has been changed to indicate a single layer of vertical reinforcement with every other hook pointing to the opposite direction in the footing.

Comment: *Provide temperature and shrinkage control reinforcing steel properly placed in both directions of the headwalls to provide crack control. We recommend providing horizontal #4's at 12 inches.*

Response: LFR agrees. The detail has been changed to add additional horizontal #4 rebars at two levels in the foundation.

Conclusions and Recommendations

Comment: *Experienced engineers who are knowledgeable in dam and concrete construction should be at the site during construction to provide immediate advice to unexpected conditions. Foundation approval by DLNR is required prior to placing the backfill.*

Response: LFR agrees. We will provide an experienced engineer during construction.

Comment: *Grouting pressure should be closely monitored and adjusted if necessary to avoid hydraulic facture or uplift of the embankment.*

Response: LFR agrees. The grouting pressure will be continuously monitored and adjusted as necessary to avoid hydraulic factures and uplifting of the embankment.

Comment: *The backfill should be compacted to the same density as the existing embankment to have same elasticity or stiffness as the existing embankment.*

Response: LFR agrees. The fill notes have been changed to indicate the backfill will be compacted to the same density as the existing embankment.

Comment: *Provide the types of compacting equipment to be used and the types and the frequency of soil density tests.*

Response: See above response.

Comment: *Avoid stepping of benching at the steep slope or the edge of each horizontal lift.*

Response: See above response.

Comment: *Provide the specifications of the flowable fill.*

Response: See above response.

Comment: *Provide the design details of the valve and its foundation for review.*

Response: See above response.

If you have any questions or comments, please feel free to contact Mark Vaught at (808) 579-9516 or me at (808) 522-0321.

Sincerely,

Jeffrey C. Morrell
Principal Engineer

Attachments:

1. Revised drawings
2. Revised scope of work
3. Revised construction schedule

1970 TO 2010 40 YEARS

GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Memorandum of Design Review
"Kapalaalaea Dam"
Waikapu, Maui, Hawaii
February 19, 2010
By T. C. Liu

References

1. Report of Periodic Inspection, Kapalaalaea Dam, Maui, Hawaii, by Steve Verigin, November 13, 2007
2. Design Drawings, Sheets C1 - C3, by LFR, 10-31-2008.
3. Limited Visual Dam Safety Inspection Summary Report, MA-094, Kapalaalaea Reservoir, Maui, Hawaii", by U.S. Army Corps of Engineers, May 2006.
4. Memorandum of Design Review, Kapalaalaea Dam, Waikapu, Maui, Hawaii, by T. C. Liu, December 18, 2008.
5. LFR February 20, 2009 letter to DLNR, Repair Application and Final Design Report for the repair of the outlet of Kapalaalaea Dam, Island of Maui, Hawaii.
6. Design Drawings, Sheets C1 – C3, by LFR, 02-18-2009.
7. Kapalaalaea Outlet Repair, Scope of Work, East Maui Irrigation, revision 3 - 2/20/2009, by LFR.
8. Memorandum of Design Review, Kapalaalaea Dam, Waikapu, Maui, Hawaii, by T. C. Liu, March 17, 2009.
9. DLNR April 16, 2009 letter to Mr. Jeffrey C. Morrell of LFR Inc.
10. LFR September 22, 2009 letter to DLNR with response to March 17, 2009 Memorandum of Design Review.

Background

A sinkhole was discovered on the upstream face of the dam approximately 20 to 25 feet downstream of the outlet trashrack on the alignment of the outlet pipe.

The owner excavated the area in November 2007 and exposed the sinkhole for inspection. Based on the recommendations given in GEI's November 13, 2007 inspection report, the owner's engineer, LFR, submitted a preliminary design on November 10, 2008 for the repair of the outlet pipe. GEI performed design reviews and provided comments and recommendations in the December 18, 2008 and March 17, 2009 memoranda.

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EXHIBIT 5

Project Description

The dam consists of an earthfill embankment. The dam is approximately 45 feet tall and 350 feet long. The outlet, 230 feet long, consists of a 16-inch diameter steel pipe sliplined within an uncased 20-inch diameter cast iron pipe with a downstream control valve.

Review

We have reviewed LFR's September 22, 2009 letter (Reference No. 10) and provide the following comments.

General Comments

Most of the responses are acceptable.

Follow-up Comments on Sheet No. C2, Section B regarding stepping or benching

Small compacting equipment should be used to compact the toe or the bottom of the bench or step to reach the required relative density.

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

MAR 15 2010

Mr. Mark Vaught
East Maui Irrigation Company
P.O. Box 791628
Paia, Hawaii 96779

Dear Mr. Vaught:

DAM SAFETY CONSTRUCTION/ALTERATION PERMIT NO. 38
KAPALAALAEA RESERVOIR (HI0094)
OUTLET PIPE REPAIR, PAIA, MAUI
PROPOSED PERMIT APPROVAL CONDITIONS

The Department of Land and Natural Resources (Department) has reviewed your permit application for the above noted project. The Dam Safety program will be recommending that the Board of Land and Natural Resources (BLNR) approve the permit subject to the following special conditions and the attached General Conditions:

1. The owner shall schedule and hold a Pre-construction meeting and notify the Department at least 15 days prior to the meeting.
2. The owner shall prepare and submit a construction schedule in accordance with the General Condition item 4. The owner shall inform the Department prior to reaching critical items with adequate lead time so that the Department may decide to be in attendance to observe specific construction tasks. The Department shall identify milestones of interest, which the owner shall provide notice so that a representative from the Department may be present.
3. The owner's engineer in charge of the construction inspection shall forward a copy of the daily inspection logs, on a weekly basis or as directed by the Department. A copy of any change orders shall be included in this submittal.
4. The owner shall submit a reservoir filling plan prior to the completion of construction in accordance with General Condition Item 8. The filling plan shall be approved prior to re-filling of the reservoir.

EXHIBIT 6

5. The owner shall schedule a final construction inspection to be conducted prior to refilling of the reservoir. The owner shall inform the Department of the final construction inspection date with adequate time for the Department to plan for attendance at the inspection.
6. The owner shall submit As-built drawings in accordance with the General Condition item 10 within six (6) months of completion of construction.

Please respond by March 19, 2010 if you have any concerns to these conditions. If the conditions are acceptable, we would make recommendation for approval at the next BLNR board meeting. If you have any questions, please feel free to contact John Dawley at (808) 587-0272 or Jimmy Leung at (808) 587-0238.

Sincerely,

Carty S. Chang
Acting Chief Engineer

Enclosure

cc: Mr. Jeffrey C. Morrell, LFR

DAM SAFETY PERMIT GENERAL CONDITIONS

APPROVAL OF PLANS AND SPECIFICATIONS FOR DAM AND RESERVOIR CONSTRUCTION, ENLARGEMENT, REPAIR, ALTERATION OR REMOVAL

The following General Conditions shall be adhered to for all Dam Safety permits unless otherwise authorized in writing.

1. Construction work shall commence within five years of the date of the approved application.
2. A licensed engineer in the State of Hawaii shall be in charge of the inspection of the construction.
3. One set of final plans and specifications with the County approval (signature) shall be submitted to the Department prior to the start of the work.
4. The Department shall be notified five (5) calendar days prior to the commencement of the construction, and a construction schedule shall be provided, which includes the notice to proceed date and estimated project duration.
5. Changes and/or modifications to the plans shall be sent to the Engineering Division in the form of shop drawings and/or plans that are approved and stamped by a licensed engineer.
6. The owner shall prepare a construction emergency response plan to address personnel responses should an emergency situation arise during the construction.
7. The owner or its representative shall notify the Department fifteen (15) calendar days in advance to the final construction inspection.
8. Within fifteen (15) calendar days of completing the project, the owner or its representative shall provide the Department with a confirmation letter of compliance, signed and stamped by the construction engineer, indicating that the construction was completed in accordance to approved plans and specifications including any field changes. The construction engineer shall submit the as-built drawings within 180 calendar days of the submittal of the confirmation letter of compliance.
9. The applicant/owner shall submit one copy each of the Operations Manual and the Emergency Action Plan for the facility upon completion of the project as applicable.
10. For dams and reservoirs that have been drained or for new construction, the applicant/owner shall inform the Department at least fifteen (15) calendar days in advance before filling the reservoir. The applicant/owner shall follow a filling plan and provide documentation of monitoring during the filling operation.
11. The applicant/owner shall utilize appropriate erosion control best management practice measures during construction to minimize turbidity (such as scheduling of work during periods of low stream flow) and prevent debris and construction materials, including cement, petroleum products, and other pollutants from enter the waters of the State. Construction related water and debris should be properly disposed of in a legal and environmentally safe manner.
12. The applicant/owner shall comply with all applicable Federal, State, and County regulations.

Exhibit 7